REMARKS

I. Drawings and Specification

In paragraph 2 of the Office Action, the drawings were objected to as failing to comply with 37 C.F.R. 1.84(p)(5) because they do not include references 10 in Fig. 1 and 184 in Fig. 5C. Corrected drawing sheets have been submitted that include both references.

In paragraph 3 of the Office Action, the drawings were objected to as failing to comply with 37 C.F.R. 1.83(a) because they do not show reference 181 in Fig. 5C. Because a structure in Fig. 5B and Fig. 5C had been inadvertently labeled with reference number 181, corrected drawing sheets for both have been submitted to correctly label the structure described in the Specification as reference number 184. The Specification makes no mention of a reference 181, and the drawing has been amended accordingly.

In paragraph 4 of the Office Action, the drawings were objected to because a wrong reference number "208" had been assigned for the signal CREST in Fig. 5. Corrected drawing sheets have been submitted that clarifies CREST as reference number "205."

The paragraph beginning on page 7, line 12 of the specification has been amended to remove an inadvertently inserted reference number.

The paragraph beginning on page 7, line 22 of the specification has been amended to correctly identify the reference number of a structure in Fig. 4.

The paragraph beginning on page 9, line 17 of the specification has been amended to correctly identify the reference number of a structure in Fig. 5B.

II. Claims

Claims 1-16 are pending in the subject application. Claims 1 and 9 are the independent claims.

A. 35 U.S. § 112

Claims 7, 8, 15, and 16 were rejected under 35 U.S. § 112 as failing to comply with the enablement requirement. Specifically, the Office Action states that the claim element " the wide band variance value is determined from components of the received RF signal across a bandwidth which is at least twice as wide as a bandwidth of the intended receiver signal" in

claims 7 and 15 has not been taught in the specification. Similarly, the Office Action states that specification does not teach the claim element "the narrow band variance value is determined from components of the received RF signal across a bandwidth that is less than twice a bandwidth of the intended received signal" in claims 8 and 16.

Applicants respectfully contend that the specification and figures properly enable the claims at issue. Applicants note that the use of squaring circuit 190 in Fig. 5C and squaring circuits 170-i and 170-q in Fig. 5B would clearly teach disclose to one skilled in the signal processing art, bandwidth which is "at least twice as wide as the bandwidth of the intended receiver signal" in computing the wideband and narrowband variances. This disclosure is evident by virtue of Euler's trigonometric relations that state the following:

$$\sin \omega t = \frac{e^{j\omega t} - e^{-j\omega t}}{2j} \qquad \text{and} \qquad \cos \omega t = \frac{e^{j\omega t} + e^{-j\omega t}}{2}$$

Therefore, by squaring a sin wave one would obtain:

$$\sin^2 \omega t = \frac{e^{j\omega t} - e^{-j\omega t}}{2j} \times \frac{e^{j\omega t} - e^{-j\omega t}}{2j} = \frac{e^{2j\omega t} - 2e^{0} + e^{-2j\omega t}}{-4} = \frac{1}{2} - \frac{1}{2}\cos\ 2\omega t$$

which results in an output signal with a frequency that is double that of the input signal, at half the amplitude and with a dc offset of half the input amplitude. By replacing ω in the above equations with a $\Delta\,\omega$ representing a bandwidth or range of frequencies, the answer will include a $2\,\Delta\,\omega$, which is effectively twice the original bandwidth.

In the present invention, squaring circuits 190, 170-i, and 170-q multiply the incoming signals by itself, and result in output signals with a frequency double that of the input signal.

The specification has been amended to clarify the elements claimed in claims 7, 8, 15, and 16. In the last paragraph on page 9, the following sentences have been added: "The narrowband variance value is determined from components of the received RF signal across a bandwidth which is less than twice a bandwidth of the intended received signal." and "As in the case with squaring circuits 170-i and 170-q, the squaring circuit 190 results in an output signal at twice the frequency of the input RF signal. . . . The wide band variance value is determined from components of the received RF signal across a bandwidth which is at least twice as wide as a bandwidth of the intended receiver signal." As indicated above, the previously filed figures disclose the subject matter of claims 7, 8, 15, and 16, and no new matter has been introduced.

B. 35 U.S.C. § 103(a)

Claims 1-6 and 9-14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,731,703 B1 to Kurihara ("Kurihara"), in view of U.S. Patent No. 6,556,636 to Takagi ("Takagi").

The present invention relates to an automatic gain control ("AGC") circuit that compensates for added wideband signal power in a radio receiver. In a typical digital receiver, the AGC circuitry measures an output signal power of a variable gain amplifier, and compares it with a value representing the desired signal power to derive an error signal. The error signal is then used to control the variable amplifier gain so that the input signal strength coincides with the desired input signal power. The current invention provides for comparing the wideband variance of the received signal with the narrowband variance of the received signal to set the reference level of the AGC circuit. Representative independent claim 9 claims:

> An automatic gain control apparatus for use in a radio frequency receiver that outputs a down-converted, digitized signal, the apparatus comprising:
>
> a variable gain amplifier coupled to receive a radio frequency (RF) signal, the variable gain receiver amplifier having a gain control input, and to produce a gain controlled RF signal;
>
> a digitizer, connected to digitize the gain controlled RF signal to produce a received digital signal;
>
> a wideband variance detector, for determining a wideband variance value from the received digital signal;
>
> a narrowband variance detector, for determining a narrowband variance value from the received digital signal;
>
> a comparator, for comparing the wideband variance value and narrowband variance value, to set a reference level for the automatic gain control loop circuit, wherein the narrowband variance value is connected to set the gain control input on the gain controlled receiver.

Likewise, independent claim 1 contains a similar claim limitation involving the comparison of wideband variance and narrowband variance. Independent claim 1 claims a method that comprises, in part, using a narrowband variance value to set the gain control input on the gain controlled receiver "if the narrowband variance value is less than the wideband variance value."

Kurihara discloses the use of a wideband power level detector 10 and a narrowband power level detector in a receiver having an AGC function. However, Kurihara does not teach or

provide any suggestion to use a comparator element "for comparing the wideband variance value and narrowband variance value, to set a reference level for the automatic gain control loop circuit" as in independent claim 9. The AGC of Kurihara relies on the wideband power level detector 10, and does not factor the narrowband power level detector 11. (Col. 7, lines 1-31). Rather, the narrowband power level detector 11 of Kurihara is used to determine antenna terminal reception power level which is reported to the base-band circuit 7. (Col. 7, lines 46-53.) Thus, Kurihara does not teach or suggest independent claims 1 and 9 because it fails to disclose the comparison, or the use, of both the wideband variance and narrowband variance in setting the reference level for an AGC circuit.

Takagi contains a comparator element that is used in a level control circuit for a communication receiver of received Quadrature Phase Shift Keying ("QPSK") signals. Takagi's AGC circuit 10 does not contain the comparator element and does not disclose the present applications claims for controlling the gain of a received RF signal. (Col. 4, lines 49-66 through Col. 5, lines 1-5). As noted above regarding typical digital receivers, the comparator 51 of Takagi is used in connection with adjusting the gain of an intermediate analog to digital circuit by comparing the received signal with a filtered signal to calculate a disturbance signal (otherwise known as an error signal). (Col. 5, line 60-46). There is no mention in Takagi of using the comparator to compare the wideband variance value and narrowband variance value of the received signal. Thus, the combined references do not teach, or provide any motivation or suggestion to use a comparator for the purpose of comparing the wideband variance value and narrowband variance value, to set a reference level for the automatic gain control loop circuit.

Because neither reference, taken alone or in combination, renders independent claims 1 and 9 of the present invention obvious, Applicant respectfully submits that those claims are in condition for allowance. The remainder of the claims are dependent on independent claims 1 and 9, and thus are also in condition for allowance.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By______________________________
F. James Coe
Registration No. 46,630
Telephone: (978) 341-0036
Facsimile: (978) 341-0136

Concord, MA 01742-9133
Dated: 11/12/04

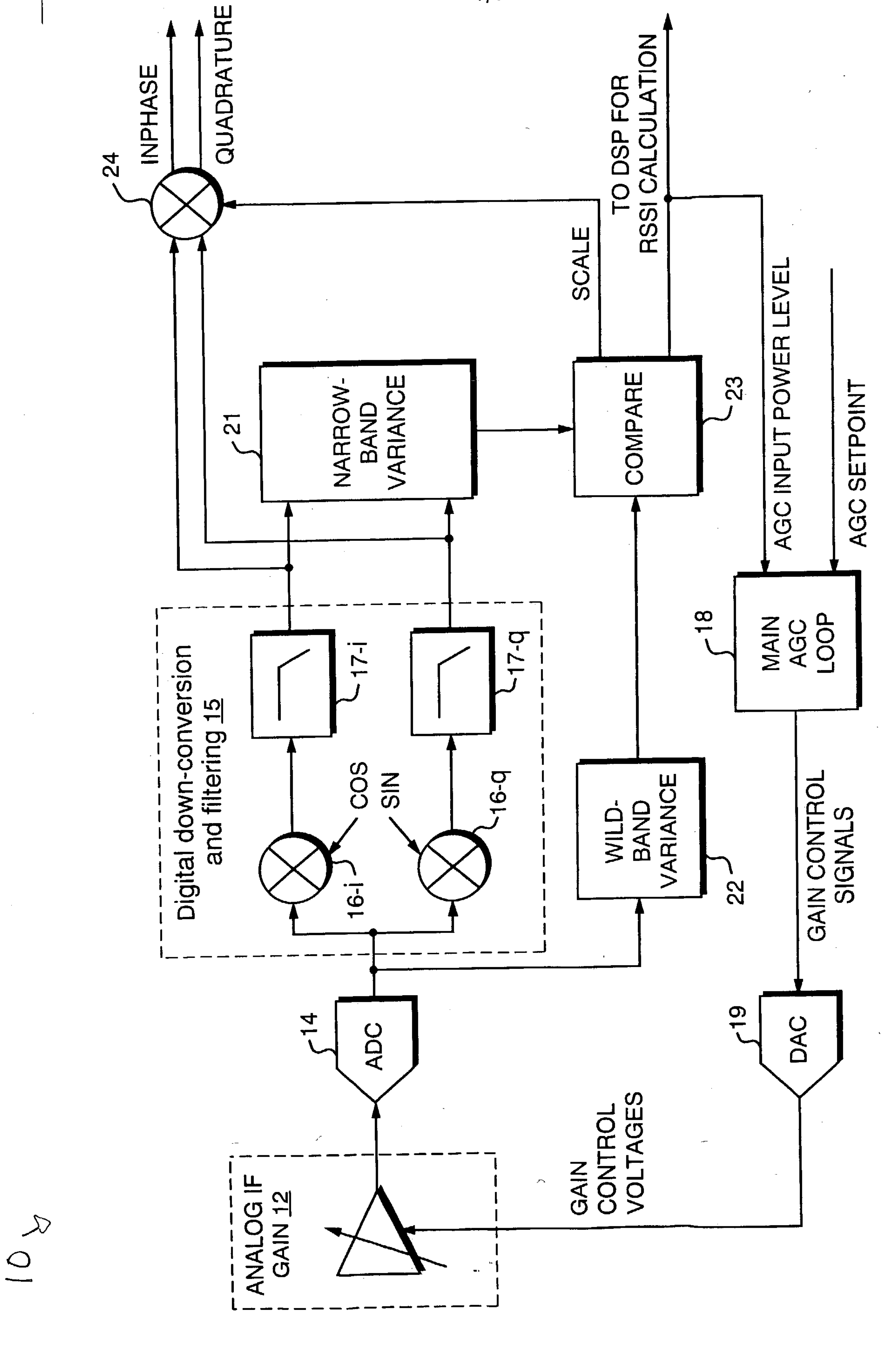
INPHASE
QUADRATURE
24
TO DSP FOR
RSSI CALCULATION
SCALE
21
NARROW-
BAND
VARIANCE
COMPARE
23
AGC INPUT POWER LEVEL
AGC SETPOINT
Digital down-conversion
and filtering 15
17-i
17-q
COS
SIN
16-i
16-q
18
MAIN
AGC
LOOP
WILD-
BAND
VARIANCE
22
GAIN CONTROL
SIGNALS
14
ADC
19
DAC
GAIN
CONTROL
VOLTAGES
ANALOG IF
GAIN 12
10

FIG. 1

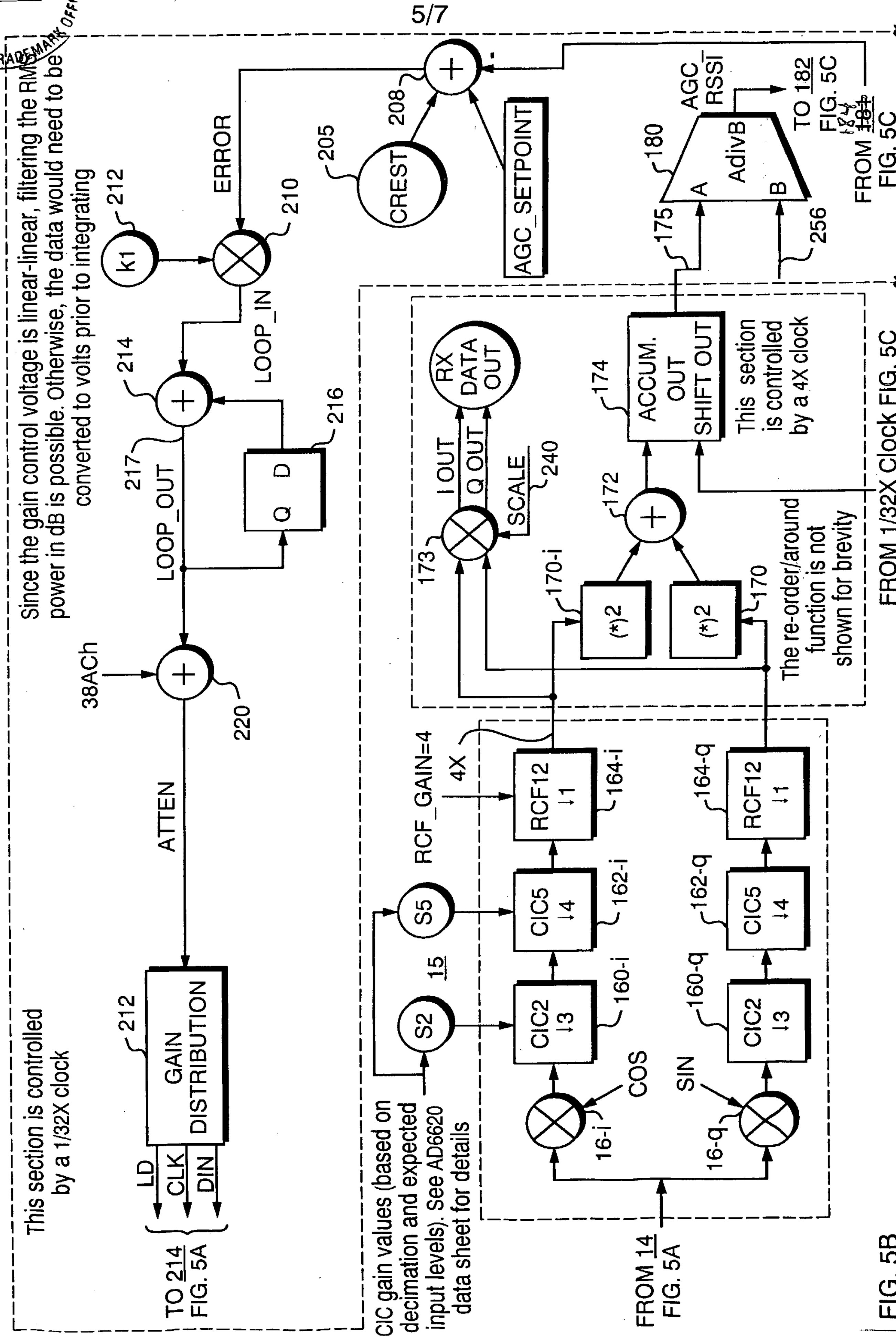
Since the gain control voltage is linear-linear, filtering the RMS power in dB is possible. Otherwise, the data would need to be converted to volts prior to integrating
This section is controlled by a 1/32X clock
212
GAIN DISTRIBUTION
LD
CLK
DIN
TO 214 FIG. 5A
ATTEN
38ACh
220
LOOP_OUT
217
214
216
Q
D
LOOP_IN
K1
212
210
ERROR
205
CREST
208
AGC_SETPOINT
CIC gain values (based on decimation and expected input levels). See AD6620 data sheet for details
S2
S5
15
RCF_GAIN=4
4X
FROM 14 FIG. 5A
COS
SIN
16-i
16-q
CIC2 ↓3
160-i
160-q
CIC5 ↓4
162-i
162-q
RCF12 ↓1
164-i
164-q
170-i
170
(*)2
172
173
I OUT
Q OUT
SCALE
240
RX DATA OUT
174
ACCUM. OUT SHIFT OUT
This section is controlled by a 4X clock
The re-order/around function is not shown for brevity
FROM 1/32X Clock FIG. 5C
175
256
180
A
B
AdivB
AGC RSSI
TO 182 FIG. 5C
FROM ~~184~~ 184 FIG. 5C

FIG. 5B

Title: "Narrowband Gain Control of..."
Inventors: Mark J. Takatz, *et al.*
Annotated Marked-Up Drawings

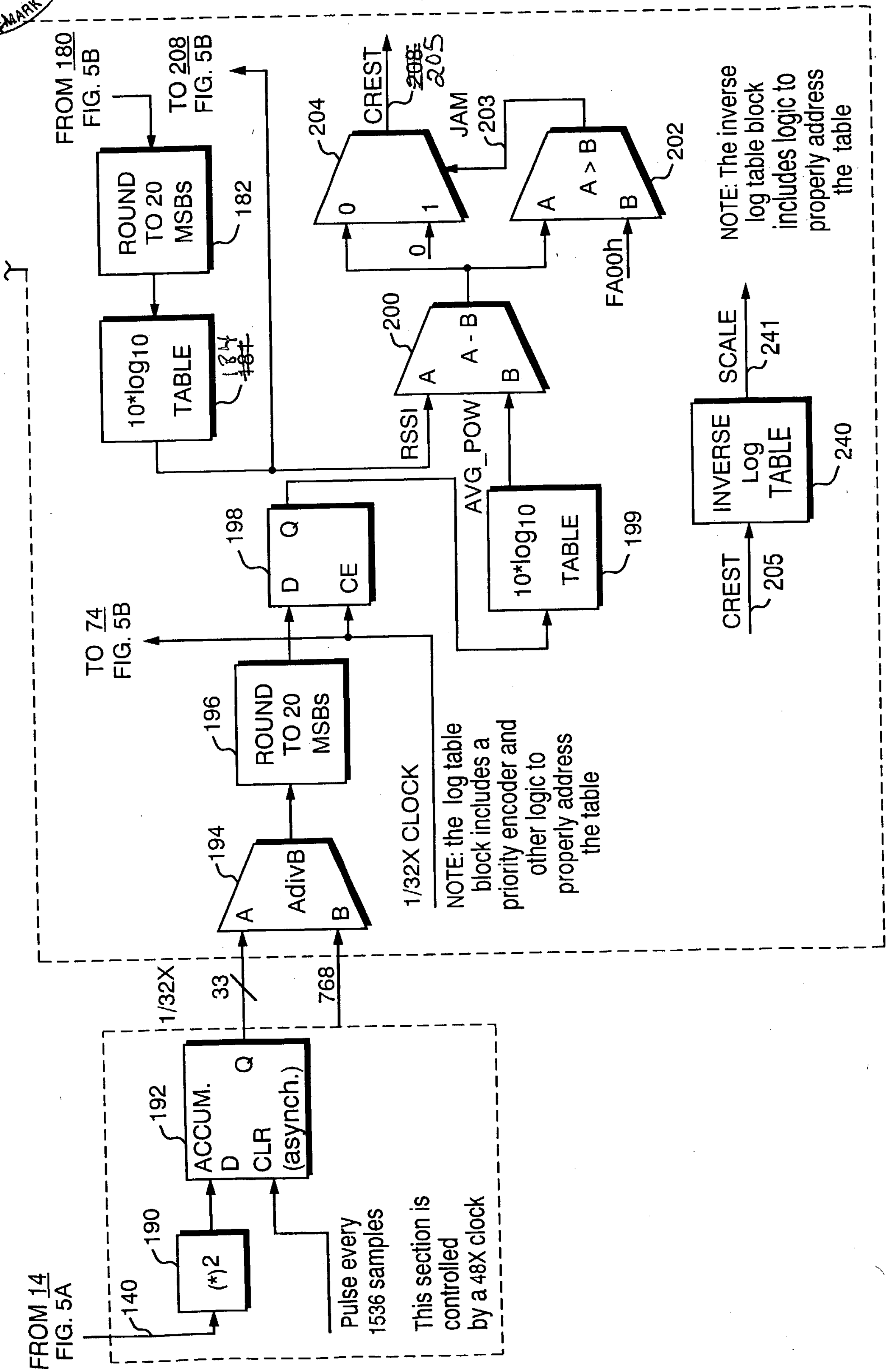

FIG. 5C